

Biological Sciences

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A four-year program leading to a B.S. in biology is offered and includes four options: biology, human biology, biotechnology, and ecology. All programs of study provide students with a liberal arts education emphasizing the sciences. The required courses in the biology specialization expose students to an examination of life from the molecular to the community level. The required courses in the biotechnology specialization emphasize cell and molecular biology. Other biology courses may be elected to suit individual interests and needs. The required courses in chemistry, mathematics, and physics reflect the interdisciplinary status of the biological sciences. Graduates of these programs have found careers in biological and medical research laboratories, biotechnology companies, and field biology, or have furthered their education by entering graduate medical, dental, optometry, veterinary, and law schools, as well as schools for allied health professions. Additional information about the Biological Sciences Department can be found at www.usm.maine.edu/bio.

Pre-professional Students

Almost every American school of medicine, veterinary medicine, and dentistry requires for admission a baccalaureate degree (major optional), two years of biology, two years of chemistry, one year of physics, a course in calculus, satisfactory performance on a national professional aptitude test, and a recommendation from a committee at the baccalaureate institution. At this campus, the Health Professions Pre-professional Evaluation Committee comprises faculty from the Departments of Biology, Chemistry, and Physics and is responsible for evaluating, comparing, and recommending students. For further information contact Patricia O'Mahoney-Damon, 225 Science Building, Portland.

Pre-pharmacy Program

A two-year, non-degree program of study is offered to prepare students to apply to a four-year doctoral program in pharmacy (a 2+4 program). Most schools and colleges of pharmacy require 60-75 credits in their two-year pre-pharmacy phase, depending on the number of general education credits required. Individual programs vary in the general education courses they require, e.g., economics, social science, humanities, and fine arts, so students should consult those programs accordingly. The pre-pharmacy concentration is a time-intensive program that students will need to commit to upon entering the University. Students are encouraged to take summer courses to reduce the number of credits taken each semester. If students choose not to take summer courses, they should consider extending the program to three years. If they do well in this program of study, they will be competitive with students from other universities applying for entry into professional pharmacy programs. If students decide not to transfer after two years, they will be well along the path toward earning a B.S. in biology degree. For further information contact Patricia O'Mahoney-Damon, 225 Science Building, Portland.

Post-Baccalaureate Pre-Medical Certificate

This certificate program is designed for students who already have graduated from college with a baccalaureate degree and who seek to fulfill the science course requirements for admission to schools of medicine or dentistry or to physician assistant programs.

Post-Baccalaureate Pre-Veterinary Certificate

This certificate program is designed for students who already have graduated from college with a baccalaureate degree and who seek to fulfill the science course requirements for admission to schools of veterinary medicine.

Lewiston-Auburn College Courses

The following Lewiston-Auburn College courses fulfill the corresponding pre-requisite requirements in the Department of Biological Sciences: SCI 105K = BIO 105K, SCI 106K = BIO 106K, SCI 107 = BIO 107, SCI 170 = BIO 111, SCI 171 = BIO 112, SCI 172 = BIO 211, and SCI 173 = BIO 212.

Programs and Requirements

Bachelor of Science: Biology

The minimum number of credits (exclusive of the University's Core curriculum) required for the major: 73. A grade of C- or higher is required for all courses listed below.

All of the following are required:

BIO	105K, 106K	Biological Principles I: Cellular Biology and Laboratory
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology
BIO	109	Biological Principles III: Functional Biology
BIO	201	Genetics
BIO	217	Evolution

One lecture/laboratory combination from each of the following four areas:

AREA 1: Organismal Biology

BIO	205	Comparative Vertebrate Anatomy
BIO	231	Botany
BIO	291	Ornithology
BIO	335	Entomology
BIO	351	Invertebrate Zoology
BIO	353W	Vertebrate Zoology
BIO	361, 362	Parasitology and Laboratory
BIO	405W, 406	Animal Behavior and Laboratory

AREA 2: Community-Ecosystem

BIO	331, 332	Ecological Principles and Field Ecology
BIO	337	Marine Ecology
BIO	383	Plant Ecology
BIO	415, 416	Microbial Ecology and Laboratory

AREA 3: Functional Biology

BIO	321, 322	Neurobiology and Laboratory
BIO	381	Plant Physiology
BIO	401, 402	General Physiology and Laboratory
BIO	403, 404	Comparative Physiology and Laboratory

AREA 4: Cellular Biology

BIO	305, 306W	Developmental Biology and Laboratory
BIO	311, 312W	Microbiology and Laboratory
BIO	409, 410	Cell and Molecular Biology and Laboratory

In addition to BIO 105K, 106K, 107, 109, 201, 217, and one course each from the four stipulated areas, biology majors are required to take either two additional biology lecture courses or one biology lecture/laboratory course, with prefix numbers of 200 or above.

The biology major must also satisfactorily complete all of the following:

Chemistry (16 credit hours)

CHY	113K, 114K,	
	115, 116	Principles of Chemistry I and II and Laboratory
CHY	251, 252	
	253	Organic Chemistry I and II and Organic Chemistry Laboratory I

Physics (10 credit hours)

PHY	111K, 114K,	
	112, 116	Elements of Physics I and II and Laboratory
		or
PHY	121K, 114K,	
	123, 116	General Physics I and II and Laboratory

Mathematics (8 credit hours)

MAT	152D	Calculus A
MAT	220	Statistics for the Biological Sciences

In addition, students must fulfill the University Core curriculum requirements.

Bachelor of Science: Biology with Emphasis in Biotechnology

The minimum number of credits (exclusive of the University's Core curriculum) required for the emphasis in biotechnology: 80. Students may substitute Problems in Biology for no more than one of the required AMS courses shown below. Per University policy, students enrolled in AMS courses pay graduate tuition rates. A grade of C- or higher is required for all courses listed below.

All of the following are required:

Biology (36 credit hours)

BIO	105K, 106K	Biological Principles I: Cellular Biology and Laboratory
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology
BIO	201	Genetics
BIO	311, 312W	Microbiology and Laboratory
BIO	408	Experimental Genetics
BIO	409, 410	Cell and Molecular Biology and Laboratory
or		
AMS	530, 531	Molecular Biology and Laboratory
BIO	431	Principles of Immunology
AMS	551	Immunology Laboratory or Problems in Biology

Chemistry (26 credit hours)

CHY	113K, 114K	Principles of Chemistry I and II and Laboratory
	115, 116	
CHY	251, 252	Organic Chemistry I and II and Laboratory
	253, 254	
CHY	461, 462	Biochemistry I and II and Laboratory
	463	

Physics (10 credit hours)

PHY	111K, 114K	Elements of Physics I and II and Laboratory
	112K, 116	
or		
PHY	121K, 114K,	General Physics I and II and Laboratory
	123, 116	

Mathematics (8 credit hours)

MAT	152D	Calculus A
MAT	220	Statistics for the Biological Sciences

Bachelor of Science: Biology with Emphasis in Human Biology

The minimum number of credits (exclusive of the University's Core curriculum) required for the emphasis in human biology: 82. A grade of C- or higher is required for all courses listed below.

All of the following are required:

BIO	105K, 106K	Biological Principles I: Cellular Biology and Laboratory
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology
BIO	111, 112	Human Anatomy and Physiology I and Laboratory
BIO	211, 212	Human Anatomy and Physiology II and Laboratory
BIO	345	Pathophysiology
BIO	401, 402	General Physiology and Laboratory

Choose 15 credits from the following:

BIO	201	Genetics
BIO	205	Comparative Vertebrate Anatomy
BIO	305, 306W	Developmental Biology and Laboratory
BIO	311, 312W	Microbiology and Laboratory
BIO	321, 322	Neurobiology and Laboratory
BIO	361, 362	Parasitology and Laboratory
BIO	409, 410	Cell and Molecular Biology and Laboratory
BIO	431	Principles of Immunology

The following courses are also required:

Chemistry (23-24 credit hours)

CHY	113K, 114K	Principles of Chemistry I and II and Laboratory
	115, 116	

CHY	251, 252	Organic Chemistry I and II and Laboratory
	253, 254	
CHY	461, 462	Biochemistry I and Laboratory
		or
CHY	461, 463	Biochemistry I and II
Physics (10 credit hours)		
PHY	111K, 114K,	Elements of Physics I and II and Laboratory
	112K, 116	
		or
PHY	121K, 114K,	General Physics I and II and Laboratory
	123, 116	
Mathematics (8 credit hours)		
MAT	152D	Calculus A
MAT	220	Statistics for the Biological Sciences

Bachelor of Science: Biology with Emphasis in Ecology

The minimum number of credits (exclusive of the University's Core curriculum) required for the major: 78. *All students must take at least three field labs. A grade of C- or higher is required for all courses listed below.

All of the following are required:

BIO	105K, 106K	Biological Principles I: Cellular Biology and Laboratory
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology
BIO	109	Biological Principles III: Functional Biology
BIO	201	Genetics
BIO	217	Evolution
BIO	331	Ecological Principles

Organismal Biology courses: Choose at least 10 credits from the following:

BIO	205	Comparative Vertebrate Anatomy
BIO	231	Botany*
BIO	291	Ornithology*
BIO	311	Microbiology
BIO	312W	Microbiology Laboratory
BIO	335	Entomology*
BIO	351	Invertebrate Zoology
BIO	353W	Vertebrate Zoology*
BIO	361	Parasitology
BIO	362	Parasitology Laboratory
BIO	381	Plant Physiology
BIO	405W	Animal Behavior
BIO	406	Animal Behavior Laboratory*

Ecology courses: Choose at least 10 credits from the following

BIO	332	Field Ecology*
BIO	337	Marine Ecology*
BIO	383	Plant Ecology*
BIO	403	Comparative Animal Physiology
BIO	404	Comparative Animal Physiology Laboratory
BIO	415	Microbial Ecology
BIO	416	Microbial Ecology Laboratory*
ESP	303	Wetlands Ecology*
ESP	341	Limnology*

Additional required courses:

Geography-Anthropology (3 credit hours)

GEO	108	Introduction to ArcGIS
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Chemistry (16 credit hours)

CHY	113K, 114K,	Principles of Chemistry I and II and Laboratory
	115, 116	
CHY	251, 252	Organic Chemistry I and II and Organic Chemistry
	253	Laboratory I

- Physics (10 credit hours)
 PHY 111K, 114K, Elements of Physics I and II and Laboratory
 112, 116
- or**
- PHY 121K, 114K, General Physics I and II and Laboratory
 123, 116
- Mathematics (8 credit hours)
 MAT 152D Calculus A
 MAT 220 Statistics for the Biological Sciences

Non-degree Pre-pharmacy Emphasis

The minimum number of credits required for the pre-pharmacy program, including general education requirements: 79. A grade of C- or higher is required for all courses listed below.

All of the following are required:

- BIO 105K, 106K Biological Principles I: Cellular Biology and
 Laboratory
 BIO 107 Biological Principles II: Evolution, Biodiversity,
 and Ecology
 BIO 111, 112 Human Anatomy and Physiology I and Laboratory
 BIO 211, 212 Human Anatomy and Physiology II and Laboratory

Chemistry (18 credit hours)

- CHY 113K, 114K Principles of Chemistry I and II and Laboratory
 115, 116
 CHY 251, 252 Organic Chemistry I and II and Laboratory
 253, 254

Physics (10 credit hours)

- PHY 111K, 114K, Elements of Physics I and II and Laboratory
 112, 116

Mathematics (8 credit hours)

- MAT 152D Calculus A
 MAT 220 Statistics for the Biological Sciences

Other required courses:

- ENG 100C College Writing
 ENG 120H Introduction to Literature
 PSY 101J General Psychology I
 SOC 100J Introduction to Sociology
 THE 170F Public Speaking

In addition, students must fulfill an additional 6-9 credits of general education electives, and some programs require three credits of economics.

Post-Baccalaureate Pre-Medical Certificate

In addition to a baccalaureate degree, all of the following courses or equivalent courses transferred from another institution are required. A grade of C- or higher is required for all courses listed below.

Biology (19 credit hours)

- BIO 105K, 106K Biological Principles I: Cellular Biology and
 Laboratory
 BIO 107 Biological Principles II: Evolution, Biodiversity, and
 Ecology

or

- BIO 111, 112 Human Anatomy and Physiology I and Laboratory
 BIO 211, 212 Human Anatomy and Physiology II and Laboratory

And two BIO courses with labs chosen from BIO 201/408, BIO 205, or those numbered 300 or higher

Chemistry (18 credit hours)

- CHY 113K, 114K, Principles of Chemistry I and II and Laboratory
 115, 116
 CHY 251, 252, Organic Chemistry I and II and Laboratory
 253, 254

Physics (10 credit hours)

PHY 111K, 114K, Elements of Physics I and II and Laboratory
112, 116

Mathematics (4 credit hours)

MAT 152D Calculus A

Post-Baccalaureate Pre-Veterinary Certificate

In addition to a baccalaureate degree, all of the following courses or equivalent courses transferred from another institution are required. A grade of C- or higher is required for all courses listed below.

Biology (19 credit hours)

BIO 105K, 106K Biological Principles I: Cellular Biology and
Laboratory

BIO 107 Biological Principles II: Evolution, Biodiversity, and
Ecology

BIO 311 Microbiology

BIO 312W Microbiology Laboratory

And one BIO course with lab chosen from BIO 201/408, BIO 205, or those numbered 300 or higher

Chemistry (18 credit hours)

CHY 113K, 114K, Principles of Chemistry I and II and Laboratory
115, 116

CHY 251, 252, Organic Chemistry I and II and Laboratory
253, 254

Physics (10 credit hours)

PHY 111K, 114K, Elements of Physics I and II and Laboratory
112, 116

Mathematics (4 credit hours)

MAT 152D Calculus A

Suggested Plans of Study

Because the biology curriculum includes many support courses (chemistry, physics, math) that need to be taken in addition to biology courses, the Department offers suggested plans of study, shown below, for biology majors in the general program, the biotechnology option, the human biology option, or the ecology option and for students in the pre-pharmacy program. There is no guarantee that every course listed will be offered when the student wants the course. Students should consult their academic advisors regularly.

Biology Degree Plan

Year 1

Fall semester

BIO 105K Biological Principles I: Cellular Biology 3

BIO 106K Laboratory Biology 1.5

CHY 113K Principles of Chemistry I 3

CHY 114K Laboratory Techniques I 1

ENG 100C College Writing 3

Core curriculum course 3

14.5

Spring semester

BIO 107 Biological Principles II: Evolution, Biodiversity and
Ecology 4.5

CHY 115 Principles of Chemistry II 3

CHY 116 Laboratory Techniques II 1

MAT 152D Calculus A 4

Core curriculum course 3

15.5

Year 2			
<i>Fall semester</i>			
BIO	109	Biological Principles III: Functional Biology	3
BIO	201	Genetics	3
CHY	251	Organic Chemistry I	3
CHY	252	Organic Chemistry Laboratory I	2
MAT	220	Statistics for the Biological Sciences	<u>4</u>
			15
<i>Spring semester</i>			
BIO	217	Evolution	3
BIO Area requirement			3-5
CHY	253	Organic Chemistry II	3
Core curriculum course			3
Core curriculum course			<u>3</u>
			15-17
Year 3			
<i>Fall semester</i>			
BIO Area requirement			3-5
Physics		Elements of Physics I or General Physics I	4
PHY	114K	Introductory Physics Laboratory I	1
Core curriculum course			3
Core curriculum course			<u>3</u>
			14-16
<i>Spring semester</i>			
BIO Area requirement			3-5
Physics		Elements of Physics II or General Physics II	4
PHY	116	Introductory Physics Laboratory II	1
Core curriculum course			3
General elective(s)			<u>variable</u>
			variable
Year 4			
<i>Fall semester</i>			
BIO Area requirement			3-5
BIO elective			3-5
Core curriculum course			3
General elective(s)			<u>variable</u>
			variable
<i>Spring semester</i>			
BIO elective			3-5
General elective(s)			<u>variable</u>
			variable

Note: Total credits must add up to 120. Suggested schedule is based on 8 semesters with approximately 15 credits per semester. Summer courses can reduce course load during the year.

Biotechnology Degree Plan

Year 1			
<i>Fall semester</i>			
BIO	105K	Biological Principles I: Cellular Biology	3
BIO	106K	Laboratory Biology	1.5
CHY	113K	Principles of Chemistry I	3
CHY	114K	Laboratory Techniques I	1
ENG	100C	College Writing	3
Core curriculum course			<u>3</u>
			14.5
<i>Spring semester</i>			
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology	4.5
CHY	115	Principles of Chemistry II	3
CHY	116	Laboratory Techniques II	1
MAT	152D	Calculus A	4
Core curriculum course			<u>3</u>
			15.5

<i>Year 2</i>			
<i>Fall semester</i>			
BIO	201	Genetics	3
BIO	408	Experimental Genetics	2
CHY	251	Organic Chemistry I	3
CHY	252	Organic Chemistry Laboratory I	2
MAT	220	Statistics for the Biological Sciences	<u>4</u>
			14
<i>Spring semester</i>			
BIO	311	Microbiology	3
BIO	312W	Microbiological Laboratory	2
CHY	253	Organic Chemistry II	3
CHY	254	Organic Chemistry Laboratory II	2
Core curriculum course			<u>3</u>
			13
<i>Year 3</i>			
<i>Fall semester</i>			
CHY	461	Biochemistry I	3
CHY	462	Biochemistry Laboratory	2
Physics		Elements of Physics I or General Physics I	4
PHY	114K	Introductory Physics Laboratory I	1
Core curriculum course			3
Core curriculum course			<u>3</u>
			16
<i>Spring semester</i>			
BIO	409	Cell and Molecular Biology	3
BIO	410	Cell and Molecular Biology Laboratory	2
BIO	431	Principles of Immunology	3
CHY	463	Biochemistry II	3
Physics		Elements of Physics II or General Physics II	4
PHY	116	Introductory Physics Laboratory II	<u>1</u>
			16
<i>Year 4</i>			
<i>Fall semester</i>			
AMS	530	Molecular Biology (if BIO 409 not taken)	3
AMS	531	Molecular Biology Laboratory (if BIO 410 not taken)	3
Core curriculum course			3
General elective(s)			<u>variable</u>
			variable
<i>Spring semester</i>			
AMS	551	Immunology Laboratory	3
Core curriculum course			3
Core curriculum course			3
General elective(s)			<u>variable</u>
			variable

Note: Total credits must add up to 120. Suggested schedule is based on 8 semesters with approximately 15 credits per semester. Summer courses can reduce course load during the year.

Human Biology Degree Plan

Year 1

Fall semester

BIO	105K	Biological Principles I: Cellular Biology	3
BIO	106K	Laboratory Biology	1.5
CHY	113K	Principles of Chemistry I	3
CHY	114K	Laboratory Techniques I	1
ENG	100C	College Writing	3
Core curriculum course			<u>3</u>
			14.5

<i>Spring semester</i>			
BIO	107	Biological Principles II: Evolution, Biodiversity, and Ecology	4.5
CHY	115	Principles of Chemistry II	3
CHY	116	Laboratory Techniques II	1
MAT	152D	Calculus A	4
		Core curriculum course	<u>3</u>
			15.5
Year 2			
<i>Fall semester</i>			
BIO	111	Human Anatomy and Physiology I	3
BIO	112	Practical Human Anatomy and Physiology I	1.5
CHY	251	Organic Chemistry I	3
CHY	252	Organic Chemistry Laboratory I	2
MAT	220	Statistics for the Biological Sciences	<u>4</u>
			13.5
<i>Spring semester</i>			
BIO	211	Human Anatomy and Physiology II	3
BIO	212	Practical Human Anatomy and Physiology II	1.5
CHY	253	Organic Chemistry II	3
CHY	254	Organic Chemistry Laboratory II	2
		Core curriculum course	<u>3</u>
			12.5
Year 3			
<i>Fall semester</i>			
BIO	345	Pathophysiology	3
CHY	461	Biochemistry I	3
CHY	462	Biochemistry Laboratory	2
Physics		Elements of Physics I or General Physics I	4
PHY	114K	Introductory Physics Laboratory I	<u>1</u>
			13
<i>Spring semester</i>			
BIO	elective		3-5
CHY	463	Biochemistry II (if CHY 462 not taken in Fall)	3
Physics		Elements of Physics II or General Physics II	4
PHY	116K	Introductory Physics Laboratory II	1
		Core curriculum course	3
		General elective(s)	<u>variable</u>
			variable
Year 4			
<i>Fall semester</i>			
BIO	elective		3-5
BIO	elective		3-5
		Core curriculum course	3
		Core curriculum course	3
		Core curriculum course	<u>3</u>
			15-19
<i>Spring semester</i>			
BIO	401, 402	General Physiology and Laboratory	5
BIO	elective		3-5
		Core curriculum course	3
		General elective(s)	<u>variable</u>
			variable

Note: Total credits must add up to 120. Suggested schedule is based on 8 semesters with approximately 15 credits per semester. Summer courses can reduce course load during the year.

Ecology Degree Plan

Year 1

Fall semester

BIO	105K	Biological Principles I: Cellular Biology	3
BIO	106K	Laboratory Biology	1.5

CHY 113K	Principles of Chemistry I	3
CHY 114K	Laboratory Techniques I	1
ENG 100C	College Writing	3
	Core curriculum course	<u>3</u>
		14.5
<i>Spring semester</i>		
BIO 107	Biological Principles II: Evolution, Biodiversity and Ecology	4.5
CHY 115	Principles of Chemistry II	3
CHY 116	Laboratory Techniques II	1
MAT 152D	Calculus A	4
	Core curriculum course	<u>3</u>
		15.5
Year 2		
<i>Fall semester</i>		
BIO 109	Biological Principles III: Functional Biology	3
BIO 331	Ecological Principles	3
CHY 251	Organic Chemistry I	3
CHY 252	Organic Chemistry Laboratory I	2
MAT 220	Statistics for the Biological Sciences	<u>4</u>
		15
<i>Spring semester</i>		
BIO 217	Evolution	3
BIO	Organismal Course requirement	variable
CHY 253	Organic Chemistry II	3
GEO 108	Introduction to ArcGIS	3
	Core curriculum course	<u>3</u>
		variable
Year 3		
<i>Fall semester</i>		
Physics	Elements of Physics I or General Physics I	4
PHY 114K	Introductory Physics Laboratory I	1
BIO 201	Genetics	3
	BIO Ecology course requirement	variable
	Core curriculum course	<u>3</u>
		variable
<i>Spring semester</i>		
	BIO Organismal course requirement	variable
Physics	Elements of Physics II or General Physics II	4
PHY 116	Introductory Physics Laboratory II	1
	Core curriculum course	3
	Core curriculum course	<u>3</u>
		variable
Year 4		
<i>Fall semester</i>		
	BIO Ecology course requirement	variable
	Core curriculum course	3
	General Electives	<u>variable</u>
		variable
<i>Spring semester</i>		
	BIO Ecology or Organismal course requirement	variable
	Core curriculum course	3
	General Electives	<u>variable</u>
		variable

Note: Total credits must add up to 120. Suggested schedule is based on 8 semesters with approximately 15 credits per semester. Summer courses can reduce course load during the academic year.

Pre-pharmacy Program Plan

Year 1

Fall semester

BIO 105K	Biological Principles I: Cellular Biology	3
BIO 106K	Laboratory Biology	1.5

CHY 113K	Principles of Chemistry I	3
CHY 114K	Laboratory Techniques I	1
ENG 100C	College Writing	3
EYE 1XX	Entry Year Experience	<u>3</u>
		14.5
<i>Spring semester</i>		
BIO 107	Biological Principles II: Evolution, Biodiversity and Ecology	4.5
CHY 115	Principles of Chemistry II	3
CHY 116	Laboratory Techniques II	1
ENG 120H	Introduction to Literature	3
THE 170F	Public Speaking	<u>3</u>
		14.5
<i>Summer session</i>		
PHY 111K	Elements of Physics I	4
PHY 114K	Introductory Physics Laboratory I	1
PHY 112	Elements of Physics II	4
PHY 116	Introductory Physics Laboratory II	<u>1</u>
		10
Year 2		
<i>Fall semester</i>		
BIO 111	Human Anatomy and Physiology I	3
BIO 112	Practical Human Anatomy and Physiology I	1.5
CHY 251	Organic Chemistry I	3
CHY 252	Organic Chemistry Laboratory I	2
MAT 152D	Calculus A	4
PSY 101J	General Psychology I	<u>3</u>
		16.5
<i>Spring semester</i>		
BIO 211	Human Anatomy and Physiology II	3
BIO 212	Practical Human Anatomy and Physiology II	1.5
CHY 253	Organic Chemistry II	3
CHY 254	Organic Chemistry Laboratory II	2
MAT 220	Statistics for Biological Sciences	4
SOC 100J	Introduction to Sociology	<u>3</u>
		16.5

Summer Session (general education requirements vary by program so check individual program requirements)

Economics	Introduction to Macroeconomics or Introduction to Microeconomics	3
General education electives (ex: ART, PHI, HTY)		<u>3-6</u>
		6-9

Minor in Biology

The minimum number of credits (exclusive of the University's Core curriculum) required for the minor: 18. A grade of C- or higher is required for all courses in the minor.

The minor consists of 18 credit hours of biology coursework. Students can begin with the general biology sequence of BIO 105K, BIO 106K, BIO 107, and BIO 109, or the human biology sequence of BIO 111, BIO 112, BIO 211, and BIO 212. Students must then take additional upper-level electives (200 or above) to equal a total of 18 credit hours. At least 6 credit hours of these upper-level courses must be taken within the Department of Biological Sciences.

Laboratory Fees

A laboratory fee is assessed in biology laboratory courses.

BIO 101K Biological Foundations

An introduction to the areas of current biological interest: molecular and cellular biology, genetics and development, and evolution and population biology. Intended primarily for students selecting a laboratory science to satisfy the Core curriculum or for those students not intending to take other courses in the biological sciences. This course cannot be used as a prerequisite for other biology courses. Cr 3.

BIO 102K Biological Experiences

Laboratory studies to complement and illustrate the concepts presented in BIO 101K. Prerequisite: Prior or concurrent registration in BIO 101K. Cr 1.

BIO 103K Introduction to Marine Biology

A course intended for the non-science major. Selected groups of marine plants and animals are used to develop an understanding of biological processes and principles that are basic to all forms of life in the sea. Integrated in the course are aspects of taxonomy, evolution, ecology, behavior, and physiology. Cr 3.

BIO 104K Marine Biology Laboratory

An examination of prototype organisms will be used to illustrate their varied roles in the ocean. Prior or concurrent registration in BIO 103K. Cr 1.

BIO 105K Biological Principles I: Cellular Biology

This is an introduction to the scientific principles of molecular biology, cell biology, and genetics. Prerequisite: students must have fulfilled the University minimum proficiency requirements in writing and mathematics. Cr 3.

BIO 106K Laboratory Biology

Laboratory experiences illustrating concepts and principles introduced in BIO 105K. Concurrent enrollment in BIO 105K is highly recommended. Prerequisite: grade of C- or higher or concurrent enrollment in BIO 105K. Students must have fulfilled the University minimum proficiency requirements in writing and mathematics. Cr 1.5.

BIO 107 Biological Principles II: Evolution, Biodiversity, and Ecology

This is an integrated lecture-laboratory course introducing students to the scientific principles of evolution, biodiversity, and ecology. The lecture and laboratory each meet three hours weekly. Prerequisites: grades of C- or higher in BIO 105K and BIO 106K. Cr 4.5.

BIO 109 Biological Principles III: Functional Biology

This is an introduction to the scientific principles of structure and function in plants and animals. Prerequisite: grade of C- or higher in BIO 107. Cr 3.

BIO 111 Human Anatomy and Physiology I

The course is the first semester of a two-semester

sequence concerning the structure and function of the human body. The course focuses on the study of cell chemistry, cell physiology, tissues, integumentary system, skeletal system, muscle system, and nervous system. Prerequisite: satisfactory completion of minimum proficiency requirements. Cr 3.

BIO 112 Practical Human Anatomy and Physiology I

Laboratory experiences illustrating concepts and principles introduced in BIO 111. The course will cover the following topics: metrics, language of anatomy, cell physiology, tissues, integumentary system, skeletal system, muscular system, and nervous system. Prerequisite: BIO 111 or concurrent. Cr 1.5.

BIO 201 Genetics

This is a study of the molecular basis of heredity and methods of genetic analysis. Prerequisites: grade of C- or higher in BIO 107 or BIO 211 and 212, and CHY 115; or permission of instructor. Cr 3.

BIO 205 Comparative Vertebrate Anatomy

The comparative study of vertebrate organ systems from an adaptational and evolutionary point of view. Lecture three hours/week; one four-hour laboratory/week. Prerequisites: grade of C- or higher in BIO 109. Cr 5.

BIO 211 Human Anatomy and Physiology II

This course is a continuation of BIO 111. The structure and function of the endocrine, cardiovascular, respiratory, digestive, and urinary systems will be discussed. Prerequisite: grade of C- or higher in BIO 111. Cr 3.

BIO 212 Practical Human Anatomy and Physiology II

Laboratory studies of the structure and function of the endocrine, cardiovascular, respiratory, reproductive, digestive, and urinary systems. Prerequisite: grade of C- or higher in BIO 112; BIO 211 or concurrently. Cr 1.5.

BIO 217 Evolution

This course teaches the geological and fossil records; the mechanism of selection as a creative principle; the genetic basis of natural selection; the pervasive imprint of evolution in living and fossil species; the evolution of complex molecules and organ systems; and the geological and ecological processes that have influenced diversification. Prerequisite: grade of C- or higher in BIO 107, or permission of instructor. Cr 3.

BIO 231 Botany

A study of structure, function, development, reproduction, and environmental adaptations of representative non-vascular and vascular plants. Lecture three hours/week; one three-hour laboratory/week. Prerequisite: grade of C- or higher in BIO 107 or permission of instructor. Cr 4.5.

BIO 251 History of Biology

A chronological survey of developments in biological investigations from earliest records to the present day. Prerequisite: grade of C- or higher in BIO 105K or 111, or permission of instructor. Cr 3.

BIO 281 Microbiology and Human Disease

Fundamentals of microbiology with emphasis on infectious diseases of people, including bacteria, rickettsia, fungi, viruses, protozoa and helminths. Prerequisites: grade of C- or higher in BIO 105K or BIO 111, and CHY 107. Cr 3.

BIO 282 Microbiology and Human Disease Laboratory

Laboratory techniques in the cultivation, identification, and control of microorganisms. Prerequisite: BIO 281 or concurrently. This course does not fulfill the Area 4 requirement. Cr 2.

BIO 291 Ornithology

This course studies the basic biology of birds: their life histories, migration, ecology, and economic importance, with emphasis on species found in Eastern North America. Numerous field trips to a variety of habitats will be taken for purposes of field identification. Students are responsible for their own appropriate outdoor clothing and footwear and for binoculars. Prerequisite: a grade of C- or higher in BIO 107, or permission of instructor. Cr 4.5.

BIO 305 Developmental Biology

An analysis of the cellular and molecular interactions leading to normal development. Prerequisite: grade of C- or higher in BIO 107. Cr 3.

BIO 306W Developmental Biology Laboratory

This laboratory course is designed to illustrate principles of animal development introduced in BIO 305 using genetic, histochemical, and molecular analyses. Prerequisite: prior or concurrent registration in BIO 305. Cr 2.

BIO 311 Microbiology

This course is a comprehensive introduction to cellular, biochemical, and genetic aspects of prokaryotes. Viruses and some eukaryotic micro-organisms are also considered. Prerequisites: CHY 115 and grade of C- or higher in BIO 107; or permission of instructor. Cr 3.

BIO 312W Microbiological Laboratory

The laboratory explores basic techniques of isolation and cultivation of microorganisms, primarily bacteria and fungi. In addition, biochemical, molecular, and genetic analyses of microorganisms are introduced. To fulfill the W requirement, students must be enrolled in BIO 311 and 312 concurrently. Prerequisite: grade of C- or higher or concurrent enrollment in BIO 311; or permission of instructor. Cr 2.

BIO 321 Neurobiology

This course presents an overview of nervous system function, structure, and development. Content

focuses on the cellular and molecular properties that underlie normal function. Prerequisite: grade of C- or higher in BIO 109 or BIO 111, or permission of instructor. Cr 3.

BIO 322 Neurobiology Laboratory

This laboratory course is designed to enable students to gain experience with a range of experimental techniques used in neurobiology research. These include cell culture, electrophysiology, histochemistry, microscopy, and behavioral analyses. Prerequisite: prior or concurrent registration in BIO 321. Cr 2.

BIO 331 Ecological Principles

A scientific study of interactions determining the distribution and abundance of organisms. Prerequisite: grade of C- or higher in BIO 107. Cr 3.

BIO 332 Field Ecology

Field studies demonstrating basic concepts of ecology. Prerequisite: BIO 331 or concurrently. Cr 2.

BIO 335 Entomology

Integrated lecture-laboratory course on the biology of insects and their impact on humanity. Prerequisite: grade of C- or higher in BIO 107. Cr 3.

BIO 337 Marine Ecology

A comparative ecological study of coastal and oceanic environments. Lecture, three hours/week; weekly four-hour field trip. Prerequisite: Grade of C- or higher in BIO 107. Cr 5.

BIO 345 Pathophysiology

A study of the physiological, genetic, biochemical and environmental basis of noninfectious diseases. Prerequisite: grade of C- or higher in BIO 109 or BIO 211, or permission of instructor. Cr 3.

BIO 351 Invertebrate Zoology

The morphology, physiology and evolution of invertebrate animals. Three hours of lecture and two, two-hour laboratories per week. Prerequisite: a grade of C- or higher in BIO 107. Cr 5.

BIO 353W Vertebrate Zoology

This course is a survey of the vertebrate animals, focusing on classification, morphology, physiology, ecology, behavior, and evolutionary history of each group. Lecture three hours a week; one four-hour laboratory a week. Prerequisites: grade of C- or higher in BIO 109. Cr 5.

BIO 361 Parasitology

The life histories and host-parasite relationships of animal parasites, with emphasis on those of humans. Prerequisite: grade of C- or higher in BIO 105K. Cr 2.

BIO 362 Parasitological Laboratory

The morphology and life cycles of parasitic protozoa, helminths, and arthropods. Prerequisite: BIO 361 or concurrently. Cr 2.

BIO 381 Plant Physiology

This course is a study of the physiological activities of plants, and their growth and development as influenced by internal and external factors. Lecture three hours/week; one three-hour laboratory/week. Prerequisites: CHY 115 and grade of C- or higher in either BIO 109 or BIO 231; or permission of instructor. Cr 4.5.

BIO 383 Plant Ecology

This course examines plant ecology at the population, community, and ecosystem levels. Plant adaptations to the environment are also discussed, with emphasis on how these traits influence community and ecosystem processes. Weekly field trips are required. Prerequisite: grade of C- or higher in BIO 107. Cr 5.

BIO 401 General Physiology

A study of physiological processes and their regulation in animals. Prerequisites: CHY 115, either PHY 111K or PHY 121K, and grade of C- or higher in either BIO 107 or BIO 211; or permission of instructor. Cr 3.

BIO 402 General Physiology Laboratory

Laboratory examination of physiological mechanisms in animals. Prerequisite: BIO 401 or concurrently; MAT 220. Cr 2.

BIO 403 Comparative Physiology

Physiological and biochemical basis of environmental adaptation. Prerequisites: CHY 115, junior standing, and grade of C- or higher in BIO 107. Cr 3.

BIO 404 Comparative Physiology Laboratory

Laboratory experiments on the physiological basis of environmental adaptation. Emphasis is on marine organisms. Prerequisite: BIO 403 or concurrently; MAT 220. Cr 2.

BIO 405W Animal Behavior

This course is a study of the principles of behavioral organization in vertebrate and invertebrate animals, with emphasis on behavior under natural conditions. Prerequisite: grade of C- or higher in BIO 107 or BIO 211, or permission of instructor. Cr 3.

BIO 406 Animal Behavior Laboratory

This course is a laboratory and field examination of behavioral principles in animals. Prerequisite: BIO 405 or concurrently. Cr 2.

BIO 407 Molecular Mechanisms in Development

This is a molecular genetic analysis of animal development focusing on an integrative approach toward understanding the evolution of developmental mechanisms. Prerequisite: grades of C- or higher in BIO 201 and BIO 305, or permission of instructor. Cr 3.

BIO 408 Experimental Genetics

This course includes lectures and laboratory exercises

in human and fruit fly genetics. This is not a companion course to BIO 201. Prerequisite: BIO 201 or concurrently, or permission of instructor. Cr 2.

BIO 409 Cell and Molecular Biology

A study of the eukaryotic cell at the level of organelles and molecules. The biochemical aspects of cell growth and reproduction are emphasized. Prerequisites: CHY 115 and either grade of C- or higher in BIO 201 or concurrent enrollment in BIO 201. Cr 3.

BIO 410 Cell and Molecular Biology**Laboratory**

A course in which the techniques of cell fractionation and biochemical analyses are applied to the eukaryotic cell. Prerequisite: BIO 409 or concurrently. Cr 2.

BIO 415 Microbial Ecology

This course is a continuation of BIO 311. The course begins with an examination of microbial evolution and biodiversity. It then explores the interactions of microorganisms in populations and within communities, and their interactions with other organisms and the environment, including an examination of physiological adaptations and biogeochemical cycles. Prerequisite: grade of C- or higher in BIO 281 or BIO 311 or equivalent, or permission of instructor. Cr 3.

BIO 416 Microbial Ecology Lab

This is the companion lab course to BIO 415, designed as a hands-on project lab to introduce students to a variety of methods used in microbial ecology. There will be a field component, lab component, and written component to the projects that will be completed during the semester. Microscopic, cell culture, and molecular methods will be employed. Prerequisites: grade of C- or higher in BIO 415 (or equivalent) or concurrent enrollment, or permission of instructor. Cr 2.

BIO 417 Issues in Evolution

This course surveys major issues that motivate current research in evolutionary biology, providing an historical analysis of areas of controversy and alternative points of view within the field. The course is based on selected readings in the theoretical and experimental literature of the field, from primary and classical sources. Prerequisites: grades of C- or higher in BIO 201 and BIO 217; or permission of instructor. Cr 3.

BIO 421 Biology Seminar

Weekly oral reports and discussions by students and staff on biological topics of current interest. Prerequisite: 16 hours of biology or permission of instructor. May be repeated. Cr 1 or 2.

BIO 431 Principles of Immunology

An introduction to the fundamentals of immunology, especially as they relate to human diseases. Topics include history of immunology, basic ele-

ments of immune systems, principles of natural and acquired immunity, cellular and molecular basis of B cell and T cell development and diversity, and clinical aspects of immunology. Prerequisites: CHY 105 or CHY 115, junior standing, and grade of C- or higher in either BIO 109 or BIO 211; or permission of instructor. Cr 3.

BIO 441 Problems in Biology

Independent library or laboratory studies on a special topic as mutually arranged by instructor and student. Prerequisite: by arrangement. Credit arranged.